

**WHAT IS CLAIMED IS:**

1           1.       A method for scheduling work and delivery of material for mass-producing  
2 items in a factory comprising:  
3 obtaining at least one outstanding customer order, wherein each outstanding customer of the  
4           at least one outstanding customer order includes an item ordered by a customer, and  
5           producing the item requires a required quantity of a required material;  
6 determining a current state of an available inventory of at least one material from a plurality  
7           of material sources; and  
8 periodically generating a work schedule and a material delivery schedule for producing the  
9           item using the at least one outstanding customer order and the current state of the  
10          available inventory.

          2.       The method of claim 1 wherein the determining the current state of the  
available inventory includes determining for each material of the at least one material of the  
available inventory:  
a material source of the plurality of material sources from which the material can be obtained,  
          wherein the material source is updated continuously;  
an available quantity of the available material at the material source, wherein the available  
          quantity is updated continuously; and  
an availability time of the available quantity of the material at the material source to each  
          operation of at least one operation of each manufacturing line of at least one  
          manufacturing line of the factory, wherein the availability time is updated  
11          continuously.

1           3.       The method of claim 2 further comprising:  
2 determining whether a change in the available quantity of a changed material of the at least  
3           one material of the available inventory at a changing material source of the plurality  
4           of material sources is occurring; and  
5           when the change is occurring,  
6                updating the material source for obtaining the changed material according to  
7                the change;  
8                updating the available quantity of the changed material at the changing  
9                material source;



10 updating the availability time for the available quantity of the changed  
11 material at the changing material source for each operation of the at  
12 least one operation.

1 4. The method of claim 3 wherein  
2 the available inventory includes an in-transit inventory of an in-transit material of the at least  
3 one material at an in-transit material source of the plurality of material sources; and  
4 further comprising:  
5 determining whether the in-transit inventory is affected by the change; and  
6 when the in-transit inventory is affected,  
7 determining whether the in-transit material corresponds to the changed material, and  
8 when the in-transit material corresponds,  
updating the available quantity of the in-transit material at the in-transit  
material source; and  
updating the availability time for the available quantity of the in-transit  
material at the in-transit material source for each operation of the at  
least one operation.

5 5. The method of claim 3 wherein the updating the availability time for the  
changed material at the changing material source comprises:  
determining whether the changing material source corresponds to one of an accepting  
material source and a delivering material source;  
when the changing material source corresponds to a delivering material source, setting  
6 the availability time for the material at the changing material source for each  
7 operation of the at least one operation to zero; and  
8 when the changing material source corresponds to an accepting material source,  
9 performing the following:  
10 for each operation of the at least one operation:  
11 selecting the operation as a potential destination operation for a  
12 subsequent delivery of a subsequent material of the at least one  
13 material from the accepting material source;  
14 when the accepting material source corresponds to an in-house  
15 material source, setting the availability time for the changed  
16 material at the accepting material source to a replenishment



time from the accepting material source to the potential destination operation;

when the accepting material source corresponds to an external material source, setting the availability time for the changed material to a replenishment time from the external material source to the potential destination operation;

when the accepting material source corresponds to a work-in-progress material source, setting the availability time for the changed material to the sum of a remaining time to completion at a current operation corresponding to the work-in-progress material source and a replenishment time from the work-in-progress material source to the potential destination operation;

when the accepting material source corresponds to an in-transit material source, setting the availability time for the changed material to an expected arrival time for the subsequent delivery to the potential destination operation.

6. The method of claim 2 further comprising:

identifying a scheduled material of the at least one material using the material delivery schedule, wherein the scheduled material corresponds to a scheduled material source of the plurality of material sources;

determining a scheduled quantity of the scheduled material at the scheduled material source using the material delivery schedule; and

determining an excess quantity of the scheduled material at the scheduled material source by comparing the available quantity of the scheduled material at the scheduled material source to the scheduled quantity.

7. The method of claim 6 further comprising:

delivering the excess quantity of the scheduled material from the scheduled material source to an excess material source; and

accepting the excess quantity of the scheduled material at the excess material source.

8. The method of claim 7 wherein

the delivering the excess material is delayed during the generating until after the generating;



and

the accepting the material at the excess material source is delayed during the generating until after the generating.

9. The method of claim 6 further comprising:

producing a material handling report when the excess material is determined, the material handling report including a delivery time, the excess material source, and the excess quantity of the excess material to be delivered from the scheduled material source to the excess material source;

and

delivering the excess material according to the material handling report.

10. The method of claim 2 further comprising:

producing a material handling report for a handling operation of the at least one operation, wherein the material handling report specifies moving a first quantity of a first material for producing the item at the handling operation according to the work schedule.

11. The method of claim 10 further comprising:

moving the first quantity of the first material at the handling operation according to the material handling report.

12. The method of claim 1 wherein

the generating the work schedule and the material delivery schedule assigns at least one assigned material source of the plurality of material sources for obtaining the required quantity of the required material; and  
each assigned material source is assigned such that at least one sub-quantity of the required quantity of the required material can be obtained from the assigned material source, wherein the sum of the at least one sub-quantity is no greater than the required quantity.

13. The method of claim 12 further comprising:

flagging an exception when the sum is less than the required quantity.

14. The method of claim 12 wherein



the generating the material delivery schedule includes generating a material request for delivery of a requested quantity of the required material from a transferring material source of the at least one assigned material source to a destination material source, wherein the requested quantity corresponds to a particular sub-quantity of the at least one sub-quantity of the required quantity;

and further comprising:

sending the material request to the transferring material source; and

receiving a commitment including a commitment quantity of the required material from the transferring material source.

15. The method of claim 13 wherein the commitment further comprises a commitment time for delivering the commitment quantity of the required material.

16. The method of claim 13 further comprising:

receiving a delivered quantity of a delivered material at the destination material source from the transferring material source;

comparing the delivered material to the required material; and

when the delivered material does not correspond to the required material, rejecting the delivered quantity of the delivered material;

when the delivered material corresponds to the required material and the delivered quantity is less than or equal to the committed quantity,

accepting the delivered quantity of the delivered material at the destination material source, the delivered quantity of the delivered material corresponding to an accepted quantity of the required material;

when the delivered material corresponds to the required material and the delivered quantity is greater than the committed quantity,

calculating a rejected quantity of the delivered material by subtracting the committed quantity from the delivered quantity;

accepting the committed quantity of the delivered material at the destination material source, the committed quantity of the delivered material corresponding to an accepted quantity of the required material; and

rejecting the rejected quantity of the delivered material at the destination material source.



1 17. The method of claim 16 further comprising:

2 calculating an insufficient quantity of the required material when the delivered material  
3 corresponds to the required material and the delivered quantity is less than the  
4 requested quantity.

1 18. The method of claim 16 wherein

2 the generating the work schedule and the material delivery schedule produces a current  
3 generation of the work schedule and the material delivery schedule; and  
4 the issuing, the receiving, the comparing, and the accepting are performed between the  
5 current generation and a next generation of the work schedule and the material  
6 delivery schedule.

1 19. The method of claim 12 further comprising:

2 delivering the required quantity of the required material to produce the item from the at least  
3 one assigned material source according to the material delivery schedule.

1 20. The method of claim 1 wherein

2 the obtaining the at least one outstanding customer order includes using a status for each  
3 customer order of at least one customer order, wherein the status for each customer  
4 order is updated continuously; and  
5 the status for each outstanding customer order corresponds to an outstanding status.

1 21. The method of claim 1 wherein

2 the outstanding customer orders and the current state of the available inventory are posted  
3 continuously for the generating the work schedule and the material delivery schedule.

1 22. The method of claim 1 wherein

2 the available inventory comprises external inventory.

1 23. The method of claim 1 wherein

2 the available inventory comprises work-in-progress inventory.

1 24. The method of claim 1 wherein

2 the available inventory comprises in-transit inventory.



1           25.    The method of claim 1 wherein  
2   the available inventory comprises in-house inventory.

1           26.    The method of claim 1 further comprising:  
2   initiating work to produce the item according to the work schedule.

1           27.    The method of claim 1 further comprising:  
2   analyzing each of the at least one outstanding customer order for the item to determine a  
3       routing for producing the item, wherein the routing comprises a sequence of at least  
4       one routing operation of at least one operation of at least manufacturing line of the  
5       factory;  
6   and wherein  
   the generating the work schedule and the material delivery schedule includes generating the  
     work schedule and the material delivery schedule using the routing for producing the  
     item.

          28.    The method of claim 1 wherein  
   the periodically generating the work schedule and the material schedule includes generating  
     the work schedule and the material delivery schedule every two hours.

          29.    The method of claim 1 wherein  
   a manufacturing shift comprises a number of hours less than or equal to eight; and  
   the periodically generating the work schedule and the material schedule includes generating  
     the work schedule and the material delivery schedule a plurality of times during the  
     manufacturing shift.

1           30.    The method of claim 1 wherein  
2   the plurality of material sources comprises an external material source, the external material  
3       source providing an external inventory of a first material of the at least one material of  
4       the available inventory; and  
5   the determining the available inventory of the material includes using an external visibility  
6       interface module to determine the available inventory of the first material in the  
7       external inventory.

1           31.    The method of claim 1 wherein the material delivery schedule comprises:



2 a move report for delivering a delivered quantity of a delivered material of the at least one  
3 material from a first material source of the plurality of material sources to a second  
4 material source of the plurality of material sources.

1 32. A computer system comprising:  
2 a processor; and  
3 a memory, the memory comprising instructions, the processor for executing the instructions,  
4 the instructions comprising:  
5 obtaining instructions for obtaining at least one outstanding customer order, wherein  
6 each outstanding customer of the at least one outstanding customer order  
7 includes an item ordered by a customer, and producing the item requires a  
8 required quantity of a required material;  
determining instructions for determining a current state of an available inventory of at  
least one material from a plurality of material sources; and  
generating instructions for periodically generating a work schedule and a material  
delivery schedule for producing the item using the at least one outstanding  
customer order and the current state of the available inventory.

33. The computer system of claim 32 wherein the determining instructions further  
comprise:  
source determining instructions for determining for each material of the at least one material  
of the available inventory a material source of the plurality of material sources from  
which the material can be obtained;  
source updating instructions for updating the material source continuously;  
7 quantity determining instructions for determining for each material of the at least one  
8 material of the available inventory an available quantity of the available material at  
9 the material source;  
10 quantity updating instructions for updating the available quantity continuously;  
11 time determining instructions for determining for each material of the at least one material of  
12 the available inventory an availability time of the available quantity of the material at  
13 the material source to each operation of at least one operation of each manufacturing  
14 line of at least one manufacturing line of the factory; and  
15 time updating instructions for updating the availability time continuously.





1           34.     The computer system of claim 32 wherein the generating instructions further  
2     comprise:  
3     assigning instructions for assigning at least one assigned material source of the plurality of  
4     material sources for obtaining the required quantity of the required material, wherein  
5     each assigned material source is assigned such that at least one sub-quantity of the  
6     required quantity of the required material can be obtained from the assigned material  
7     source, and wherein the sum of the at least one sub-quantity is no greater than the  
8     required quantity.

1           35.     The computer system of claim 32 wherein the obtaining instructions further  
2     comprise:  
3     status instructions for using a status for each customer order of at least one customer order to  
4     obtain the at least one outstanding customer order, wherein the status for each  
5     outstanding customer order corresponds to an outstanding status; and  
6     status updating instructions for updating the status continuously.

1           36.     A demand fulfillment system comprising:  
2     an inventory manager module for providing a current state of available in-house inventory;  
3     an external communication module for providing a current state of available external  
4     inventory and a current state of in-transit inventory;  
5     a WIP tracking and control module for providing a current state of work-in-progress  
6     inventory and outstanding customer orders, wherein a current state of an available  
7     inventory is determined using  
8     the current state of the available in-house inventory,  
9     the current state of the available external inventory,  
10    the current state of the work-in-progress inventory, and  
11    the current state of the in-transit inventory;  
12    and  
13    a scheduling module for generating a work schedule and a material delivery schedule using  
14    the outstanding customer orders and the current state of the available inventory.

1           37.     A computer readable storage medium comprising computer instructions for:  
2     obtaining at least one outstanding customer order, wherein each outstanding customer of the

3 at least one outstanding customer order includes an item ordered by a customer, and  
 4 producing the item requires a required quantity of a required material;  
 5 determining a current state of an available inventory of at least one material from a plurality  
 6 of material sources; and  
 7 periodically generating a work schedule and a material delivery schedule for producing the  
 8 item using the at least one outstanding customer order and the current state of the  
 9 available inventory.